

What is claimed is:

1. An all-optical flip-flop comprising a semiconductor laser, the semiconductor laser being equipped with a waveguide, the waveguide being equipped with a multi-mode interference portion, a plurality of input port, and an output port, the input and output ports being connected to the multi-mode interference portion, with configuration being such that a set pulse from one or more input ports and a reset pulse from (a) remaining input port(s) is inputted to the multi-mode interference portion, wherein the multi-mode interference portion transmits multi-mode light within, with light outputted due to oscillation based on the set pulse and the reset pulse inputted from the input ports being selectively outputted from the output port.
2. The all-optical flip-flop as disclosed in claim 1, wherein oscillation based on the set pulse and the reset pulse generates different modes according to the set pulse and the reset pulse.
3. The all-optical flip-flop as disclosed in claim 1, wherein a plurality of output ports are provided.
4. The all-optical flip-flop as disclosed in claim 1, wherein the input ports and the output ports are capable of allowing single mode light to pass.
5. The all-optical flip-flop as disclosed in claim 1, wherein saturable absorption regions are provided at the input ports and the output ports.
6. The all-optical flip-flop as disclosed in claim 1, wherein end surfaces of the input port and the output port are reflecting surfaces.
7. The all-optical flip-flop as disclosed in claim 1, wherein the input port doubles as the output port.
8. The all-optical flip-flop as disclosed in claim 7, wherein a mirror for reflecting inputted light is provided at the multi-mode interference.
9. The all-optical flip-flop as disclosed in claim 7, wherein circulators for switching over paths for inputted and outputted light are fitted at the input ports doubling as the output ports.

10. An all-optical flip-flop comprising a semiconductor laser, the semiconductor laser being equipped with a waveguide, the waveguide being equipped with a multi-mode interference portion, a plurality of input port, and an output port, the input and output ports being connected to the multi-mode interference portion, with configuration being such that a set pulse from one or more input ports and a reset pulse from (a) remaining input port(s) is inputted to the multi-mode interference portion, wherein the multi-mode interference portion transmits multi-mode light within, with light outputted due to oscillation based on the set pulse and the reset pulse inputted from the input ports being selectively outputted from the output port using multimode interference.